TITLE OF THE INVENTION

INFORMATION REPRODUCING APPARATUS AND INFORMATION DISPLAY
METHOD

BACKGROUND OF THE INVENTION

5   The present invention relates to an information
reproducing apparatus and an information display method for
efficiently displaying the image information reproduced from
an information storage medium such as a DVD (Digital Video
Disc or Digital Versatile Disc) as well as external

10   information from other external information sources.

The present application claims priority from Japanese
Application No.2000-349415, the disclosure of which is
incorporated herein by reference for all purposes.

As information storage media such as DVDs have come into

15   widespread use in recent years, information reproducing
apparatuses for reproducing information stored on those
information storage media have been made multifunctional.

One example is an information reproducing apparatus for
reproducing information such as the image information stored

20   on an information storage medium such as a DVD and displaying
the information on the screen of a monitor installed in a
vehicle. This apparatus is provided with a basic function such
as for displaying the image information on the monitor screen.
Being provided with this function, known is such an apparatus,

25   which further comprises a receiver tuner for receiving an FM
teletext broadcast, for displaying received information (e.g.,
information on traffic, a weather forecast, or news) on the

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monitor screen to thereby provide as much useful information
as possible.

Thus, the conventional information reproducing apparatus
has been made multifunctional to provide as much useful
information as possible. However, it cannot be said that those
pieces of information are always provided in such a manner
that users can easily make use thereof.

For example, in the case where a user such as a driver
attempts to acquire information provided in an FM teletext
broadcast while the image information reproduced from an
information storage medium is being displayed on a monitor
screen provided on an information reproducing apparatus
mounted to a vehicle, first, the user has to operate a
predetermined operation button switch or the like to interrupt
the reproducing operation on the information storage medium.
Thereafter, the user performs switching to operate the FM
receiver tuner in order to allow the information provided in
the FM teletext broadcast to appear on the monitor screen.
Then, after having acquired the desired information from the
text information displayed on the monitor screen, the user
operates the predetermined operation switch button or the like
again to restart reproducing information on the information
storage medium. That is, the user has to perform complicated
switching operations to change the contents displayed on the
monitor.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to

provide an information reproducing apparatus and an
information display method for displaying information with
improved efficiency, e.g., for displaying a plurality of
pieces of information in a manner such that the user can
5   easily make use thereof.

To achieve the aforementioned object, the present
invention provides an information reproducing apparatus for
reproducing image information stored on an information storage
medium to display the image information by a display unit. The
10   apparatus comprises an identifying unit for identifying
attribute information of a display scheme provided for the
image information, a display area setting unit for determining
a valid image-area to display the image information reproduced
and an invalid image-area excluding the valid image-area in
15   accordance with the attribute information identified by the
identifying unit, and an image information generating unit for
displaying the image information on the valid image-area, and
for simultaneously displaying external information supplied
from an external information source excluding the information
20   storage medium within the range of the invalid image-area.

To achieve the aforementioned object, the present
invention provides an information display method for
reproducing image information stored on an information storage
medium to display the image information by a display unit. The
25   method comprises the steps of identifying attribute
information of a display scheme provided for the image
information, determining a valid image-area for displaying the

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image information reproduced and an invalid image-area excluding the valid image-area in accordance with the identified attribute information, and displaying the image information on the valid image-area and simultaneously

5   displaying external information supplied from an external information source excluding the information storage medium within the range of the invalid image-area.

According to the information reproducing apparatus and the information display method of the present invention, image

10   information reproduced from an information storage medium is displayed on a valid image-area, and external information supplied from an external information source can be displayed on an invalid area which has not been conventionally used for display.

15   **BRIEF DESCRIPTION OF THE DRAWINGS**

The objects and advantages of the present invention will become clear from the following description with reference to the accompanying drawings, wherein:

Fig. 1 is an explanatory view illustrating the logical

20   data structure of DVD-Video;

Figs. 2(a) and 2(b) are explanatory views illustrating the logical data structure of video manager information and video title set information, respectively;

Fig. 3 is a block diagram illustrating a structure of an

25   information reproducing apparatus according to an embodiment;

Fig. 4 is a flowchart illustrating an operation of the information reproducing apparatus; and

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Fig. 5 is a schematic view illustrating a monitor screen on which a main image and text information acquired from an FM teletext broadcast are appearing in a display scheme of a letter box.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, the present invention will be explained below with reference to the accompanying drawings in accordance with the embodiments. As an embodiment, an apparatus for reproducing information and the method for displaying the information are described below, where the apparatus is a vehicle-mounted navigation system or the like for reproducing the information stored on a DVD-Video-compatible information storage medium (hereinafter referred to as the "DVD disc") for display.

First, referring to Figs. 1 and 2, the logical data structure of a DVD-Video-compatible DVD disc will be briefly explained.

In Fig. 1, a volume space of the DVD disc is largely divided into a volume and file structure zone for storing control information on a logical format which conforms to both the UDF (Universal Disc Format) and ISO9660, a DVD-Video zone, and DVD other zone. Of those zones, the DVD-Video zone serves as a data storage area for storing DVD-Video data. The management information necessary to reproduce DVD-Video data is also stored (recorded) on the DVD-Video zone.

Furthermore, the DVD-Video zone comprises a video manager VMG, and one or more or 99 or less video title sets VTS#1 – VTS#i.

The video manager VMG comprises a video object set VMGM_VOBS for VMG menu or the entity of a reproduced stream, video manager information VMGI or control information indicative of program chain information (PGCI) on the method for reproducing the video object set VMGM_VOBS for VMG menu, a reproduced stream attribute and the like, and backup data VMGI_BUP for video manager information VMGI.

As shown in Fig. 2(a), the aforementioned video manager information VMGI is provided with a video manager information management table VMGI_MAT for describing the attribute information VMGM_V_ATR of the video object set VMGM_VOBS for VMG menu, thereby allowing the authors of contents or the like to describe the following information as the attribute information VMGM_V_ATR in advance.

That is, the attribute information includes: a "video compression mode" for specifying a compression scheme such as MPEG1 or MPEG2; a "TV system" for specifying the number of scan lines and a field frequency upon reproducing a video stream; an "aspect ratio" for specifying the length-to-width ratio of a reproduced image; a "display mode" for specifying a display mode (such as panning scan or a letter box) which is allowed on a monitor having a 4-to-3 aspect ratio; a "source image resolution" for specifying the resolution of a reproduced image; and a "source image letter box" for specifying whether the output provided by reproducing a video stream is a letter box.

Accordingly, these pieces of attribute information

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preliminary described by the contents authors allow the
information reproducing apparatus to perform display
operations upon reproducing as the contents authors have
intended, in accordance with the attribute information

5   VMGM_V_ATR, and attribute information VTSM_V_ATR and VTS_V_ATR
which are described later.

Referring back to Fig. 1, each of the video title sets
VTS#1 - VTS#i comprises a video object set for VTS menu
VTSM_VOBS or an entity of a reproduced stream, a video object

10   set VTSTT_VOBS for video titles, video title set information
VTSI or control information indicative of the program chain
information (PGCI) on the reproducing scheme for the video
object set VTSM_VOBS for VTS menu and the video object set
VTSTT_VOBS for video titles, reproduced stream attributes and

15   the like, and backup data VTSI_BUP for the video title set
information VTSI.

As shown in Fig. 2(b), the aforementioned video title set
information VTSI is provided with a video title set
information management table VTSI_MAT for describing the

20   attribute information VTSM_V_ATR of the video object set
VTSM_VOBS for VTS menu and the attribute information VTS_V_ATR
of the video object set VTSTT_VOBS for video titles. This
allows the contents authors to describe, as the attribute
information VTSM_V_ATR and VTS_V_ATR, the same information as

25   the aforementioned attribute information VMGM_V_ATR of the
video manager information VMGI management table VMGI_MAT in
advance.

That is, as the attribute information VTSM_V_ATR and
VTS_V_ATR, it is possible to describe the aforementioned
information such as the "video compression mode", the "TV
system", the "aspect ratio", the "display mode", the "source
image resolution", and the "source image letter box". In
addition, the information reproducing apparatus is adapted to
perform display operations upon reproducing as the contents
authors have intended, in accordance with the attribute
information VTSM_V_ATR and VTS_V_ATR, and the aforementioned
attribute information VMGM_V_ATR or the so-called video stream
attribute information.

Referring back to Fig. 1, each of information VMGM_VOBS,
VTSM_VOBS, and VTSTT_VOBS comprises one or more video objects
(VOB), VOB#1 - VOB#j, VOB#1 - VOB#k, and VOB#1 - VOB#t,
respectively, and each of the video objects comprises a
plurality of cells.

That is, the cell is the unit for reproducing real time
data. It is possible to provide the video manager VMG or the
video title set VTS with a plurality of cells. In addition,
the aforementioned program chain information PCGI is adapted
to specify the order of reproducing. Incidentally, shown as a
typical example in the figure are Cell#1 - Cell#m in the video
manager VMG.

Each cell (represented by Cell#1) also comprises a
plurality of video object units (VOBU) VOBU#1 - VOBU#n.
Furthermore, each of video object units (represented by
VOBU#1) comprises a navigation pack NV_PCK which is always

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provided at the head, and a video pack V_PCK, an audio pack
A_PCK, and a sub-picture pack SP_PCK, which are provided in a
time-sharing manner as required.

The navigation pack NV_PCK comprises a presentation
control information packet PCI_PKT and a data search
information packet DSI_PKT which follow the pack header or the
like.

The sub-picture pack SP_PCK comprises a pack header and
reproduced data (compressed reproduced data) to be data
compressed for storage.

Furthermore, information on coordinates for indicating
the display area of a sub-picture is normalized for storage in
the sub-picture pack SP_PCK in a time sharing manner. This
allows the information reproducing apparatus to acquire sub-
picture stream attribute information such as the display area,
the display timing, the color, and the contrast of a sub-
picture from a sub-picture display control sequence table
SP_DCSQT in a sub-picture unit SPU which is generated by
linking a plurality of sub-picture packs SP_PCK upon
reproducing.

Now, the configuration of an information reproducing
apparatus according to this embodiment will be explained with
reference to the block diagram of Fig. 3.

The information reproducing apparatus 1 comprises a
spindle motor 3 for rotatably driving a DVD disc 2, loaded at
a predetermined clamp position, at a constant linear velocity
(or angular velocity), and an optical pickup 4 for optically

reading the information recorded on the DVD disc 2 for photoelectric conversion of the information to an electric signal Si. The information reproducing apparatus 1 also comprises a feed motor 5 for moving the optical pickup 4 in the radial direction of the DVD disc 2, an RF amplifier 6, a servo control portion 7, a digital signal processing portion 8, a buffer memory 9 formed of random access memories (RAM), and a system controller 17 for centralized control of the entire operation of the information reproducing apparatus 1.

The RF amplifier 6 generates an RF signal SRF from the electric signal Si outputted by the optical pickup 4 to output the RF signal SRF to the digital signal processing portion 8. The RF amplifier 6 also generates various error signals Se such as a tracking error signal or a focus error signal from the electric signal Si to output the error signals Se to the servo control portion 7.

In response to an instruction from the system controller 17, the servo control portion 7 performs servo control (such as focus servo, tracking servo, rotation servo, and tilt servo control) on the spindle motor 3, the optical pickup 4, and the feed motor 5 in accordance with the various error signals Se from the RF amplifier 6 and a sync error signal De detected at the digital signal processing portion 8.

The digital signal processing portion 8 permits an A/D conversion of the RF signal SRF from the RF amplifier 6 into a signal, which is in turn subjected to the signal demodulation processing and the error correction processing which conform

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to the DVD-Video data format, and then temporarily stored in the buffer memory 9. Subsequently, the digital signal processing portion 8 outputs the stored demodulated data Di to a stream separating portion 10 and the system controller 17 in accordance with an instruction from the system controller 17. The digital signal processing portion 8 also supplies the sync error signal De obtained by the demodulation and the error correction processing to the servo control portion 7.

The stream separating portion 10 separates and extracts the navigation pack NV_PCK, the video pack V_PCK, the audio pack A_PCK, and the sub-picture pack SP_PCK, which are included in the aforementioned video object unit VOBU, from the demodulated data Di supplied by the digital signal processing portion 8. Then, the stream separating portion 10 supplies the separated and extracted navigation pack NV_PCK to the system controller 17, the video pack V_PCK to a video decoder 11, the audio pack A_PCK to an audio decoder 12, and the sub-picture pack SP_PCK to a sub-picture decoder 13, respectively.

In accordance with an instruction from the system controller 17, the video decoder 11 performs the predetermined decoding processing on the video pack V_PCK and then outputs the decoded video data Dv to a video processor 14.

In accordance with an instruction from the system controller 17, the audio decoder 12 performs the predetermined decoding processing on the audio pack A_PCK to thereby generate digital audio data Da, which is in turn converted by

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a D/A converter 15 into an analog audio signal Sa having an audio frequency band for output.

In accordance with an instruction from the system controller 17, the sub-picture decoder 13 generates the sub-picture unit SPU from the sub-picture pack SP_PCK and performs the predetermined decoding processing, thereby generating data Ds of the aforementioned sub-picture to output the sub-picture data Ds to the video processor 14. The sub-picture decoder 13 also decodes sub-picture position data Dsub indicative of the display area of a sub-picture included in the sub-picture unit SPU and then supplies the resulting data to the system controller 17.

In accordance with an instruction from the system controller 17, the video processor 14 combines the video data Dv and sub-picture data Ds, which are supplied from the video decoder 11 and the sub-picture decoder 13, with OSD image data Dosd, described later, supplied from the system controller 17 together, thereby generating image data Dvd which is in turn outputted to a video encoder 16.

The video encoder 16 converts the image data Dvd for output into digital image data Ddsp and a composite signal Sdsp, which can be displayed on the monitor. Subsequently, these digital image data Ddsp and the composite signal Sdsp are supplied to the monitor (not shown), thereby displaying contents information and OSDs, described later, and so forth.

The system controller 17 is provided with a micro processor (MPU) for executing the preset system program, and

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is connected with an operation portion 18 such as a keyboard, an OSD image storage portion 19 formed of a read-only memory (ROM) and an external information storage portion 20 formed of a random access memory (RAM).

5   Furthermore, the system controller 17 can be detachably or fixedly connected with an external information supply device 21.

For example, as the external information supply device 21, the system controller 17 can be fixedly connected with a receiver tuner for receiving an FM teletext broadcast, detachably or fixedly connected with a receiver device capable of receiving an FM teletext broadcast, or detachably connected with a portable radio device (such as a mobile radio phone or a mobile information terminal device).

15   The operation portion 18 is provided with various operation button keys such as a reproducing operation key for instructing the start of reproducing, a selector key for instructing the selection of a stream, numerical keys, and alphabet keys. The user can selectively operate these operation button keys to thereby direct the desired instruction to the system controller 17.

The OSD image storage portion 19 stores the OSD image data Dosd which is used in OSD for the system controller 17 to urge the user to perform the desired operation and in OSD to inform the user of the operation status of the information reproducing apparatus 1.

Incidentally, the OSD is an abbreviation of "On Screen

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Display" and refers to displaying characters, symbols, figures
or the like on a monitor screen in accordance with the OSD
image data Dosd or the contents of display. On the other hand,
the OSD image data Dosd is in the bitmap format for expressing
5   characters, symbols, figures and the like.

In accordance with an instruction from the system
controller 17, the external information storage portion 20
stores temporarily external information supplied from the
external information supply device 21. Although specifically
10   detailed later, the system controller 17 stores the character
information supplied from the external information supply
device 21 in the external information storage portion 20. In
addition, the system controller 17 performs processing such as
converting the character information into data in accordance
15   with the OSD image data Dosd in the OSD image storage portion
19 and then supplying the resulting data to the video
processor 14.

Furthermore, as described above, in accordance with the
contents of the desired instruction provided by the user's
20   operation at the operation portion 18, the system controller
17 directs the video processor 14 to generate the image data
Dvd. The system controller 17 also analyzes the video manager
information VMGI delivered from the digital signal processing
portion 8 and stream separating portion 10, the video title
25   set information VTSI, the program chain information PGCI, the
presentation control information packet PCI_PKT, and the data
search information packet DSI_PKT to thereby perform various

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controls, necessary for reproducing, on the stream separating portion 10.

Now, the operation of the information reproducing apparatus 1 having the aforementioned structure will be explained below with reference to the flowchart shown in Fig. 4. Incidentally, an explanation is given to an information reproducing apparatus in which the system controller 17 is connected with a receiver tuner, for receiving an FM teletext broadcast, as the external information supply device 21.

Referring to Fig. 4, when the power is turned on, the operation is initiated to determine whether the DVD disc has been loaded onto the so-called clamp position (step S100).

When it has been determined that the DVD disc has been loaded, the process proceeds to a step S102 to reproduce the information stored in a predetermined area of the DVD disc and then determines whether an automatic reproducing command has been acquired. It is also determined whether the user has issued a reproducing start command from the operation portion 18. When the automatic reproducing command has been acquired or the user has issued the reproducing start command, the process proceeds to a step S104 to start reproducing the information stored in the DVD-Video zone.

Then, at a step S106, it is checked whether the value of a program timer (not shown), built in the system controller 17, has reached the predetermined update time . When the update time has not been reached (if "NO"), the process proceeds to a step S114, described later. On the other hand, when the

update time   has been reached (if "YES"), the process
proceeds to a step S108 to determine whether the external
information supply device 21 has supplied character
information as external information to the system controller
17.

At this step, when the character information has been
supplied (if "YES"), the contents of the external information
storage portion 20 is updated to the latest character
information and then the program timer is reset to start at a
step S110, and thereafter the process proceeds to the step
S114. When the character information has not been supplied (if
"NO"), the contents of the external information storage
portion 20 is cleared at a step S112 and then the program
timer is reset to start at the step S112, and thereafter the
process proceeds to the step S114.

At the step S114, which the process has reached through
the processing in any one of steps S106, S110, or S112, it is
determined whether valid character information is stored in
the external information storage portion 20. When no valid
character information is stored there, for example, when the
external information storage portion 20 has been cleared (if
"NO"), the processing is continued from the step S104. When
valid character information is stored there (if "YES"), the
process proceeds to a step S116 to check the "aspect ratio"
and "display mode" in the video stream attribute information
VMGM_V_ATR, VTSM_V_ATR, and VTS_V_ATR, which have been
reproduced from the DVD disc 2. Then, the process determines

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whether the display scheme for an main image obtained by
reproducing a video stream has been set to a letter box or
panning scan.

Then, when the display scheme of the main image has been
set to the letter box (if "YES"), the process proceeds to a
step S118 to identify the display scheme of a sub-picture or
so-called sub-image such as subtitles in accordance with the
sub-picture stream and the video stream attributes.

On the other hand, when the display scheme of the main
image has not been set to the letter box (if "NO"), the
process continues the processing from the step S104.

The process proceeds to a step S122 when the sub-image is
set to the letter box (which is identified in accordance with
the "source picture letter box information" of the video
stream attribute) at the step S118, that is, when the sub-
image is so set as to be displayed within the display area
(referred to as the "valid image-area") for displaying the
main image (if "YES").

On the other hand, even when the sub-image is not set to
the letter box, it is determined at a step S120 whether a
"sub-picture display area" overlaps an "invalid image-area" by
comparing the "sub-picture display area" obtained by the sub-
picture position data Dsub included in the sub-picture unit
SPU with the "invalid image-area" occurring outside the "valid
image-area". If not so (if "NO"), the process proceeds to the
step S122. When the "sub-picture display area" overlaps the
"invalid image-area" (if "YES"), the processing from the step

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S104 is repeated.

At the step S122, the character information stored in the external information storage portion 20 is data-converted with the OSD image data Dosd in the OSD image storage portion 19.

Subsequently, at the step S124, in order to arrange and display the converted OSD image data Dosd within the range of the "invalid image-area", the display position of the OSD image data Dosd is computed. Thereafter, at a step S126, the OSD image data Dosd added by the information on the display position is supplied to the video processor 14 for the OSD display of the character information within the range of the "invalid image-area". Then, the processing from the the step S104 is repeated.

As described above, when the attribute of the video stream reproduced from the DVD disc 2 is set to the display scheme of the letter box, the information reproducing apparatus 1 sets the "valid image-area" in accordance with the aspect ratio of the letter box as schematically shown in Fig. 5. Then, the information reproducing apparatus 1 reproduces the main image obtained by reproducing a video stream to display the main image on the "valid image-area" and multiplexes the character information supplied from the external information supply device 21 for the OSD of the resulting character information on the "invalid image-area" occurring outside the valid image-area.

Accordingly, the information reproducing apparatus 1 provides an effect of making display efficient or making use

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of the "invalid image-area" which has not been conventionally
used for effective display.

Furthermore, the user is provided with improved
convenience since a main image and character information are
made simultaneously available to the user. Character
information is also automatically displayed, thereby providing
the user with improved operability and convenience. Among
other things, the vehicle-mounted navigation device can
provide the driver or other people with useful information for
driving by displaying the image reproduced from the DVD disc
on the "valid image-area" and by displaying information such
as traffic information or weather forecast transmitted in an
FM teletext broadcast on the "invalid image-area".

Incidentally, this embodiment has exemplified a case
where the character information obtained from an FM teletext
broadcast is used for OSD while a DVD-Video-compatible DVD
disc is being reproduced. However, the present invention can
also be applied to cases for reproducing information stored on
a DVD disc which belongs to other DVD families or on other
type of information storage medium such as a CD (Compact Disc).
Furthermore, in addition to the OSD of information from an FM
teletext broadcast, it is also possible to provide the OSD of
external information provided over a global network such as an
Internet.

As described above, according to the information
reproducing apparatus and the information display method of
the present invention, the attribute information of the

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display scheme set to image information is identified. In
accordance with the attribute information identified as such,
a valid image-area for displaying the reproduced image
information and an invalid image-area excluding the valid

5   image-area are determined. The image information is displayed
on the valid image-area, and the external information supplied
from other external information source excluding an
information storage medium is displayed within the range of
the invalid image-area. Accordingly, this provides an effect

10   of making display efficient or making use of the invalid
image-area which has not been conventionally used for
effective display.

Furthermore, the user is provided with improved
convenience since a main image and character information are

15   made simultaneously available to the user. In addition,
character information is also automatically displayed, thereby
providing the user with improved operability and convenience.

While there has been described what are at present
considered to be preferred embodiments of the present

20   invention, it will be understood that various modifications
may be made thereto, and it is intended that the appended
claims cover all such modifications as fall within the true
spirit and scope of the invention.